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MCGINN & GIBB, PLLC 8321 OLD COURTHOUSE ROAD SUITE 200 VIENNA, VA 22182-3817			KEBEDE, BROOK	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 06/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicant(s)

10/627,753

Applicant(s)

LEE ET AL.

Examiner

Brook Kebede

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 and 24-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Status of the Claims

1. Claims 1-32 are pending in the application.
2. Claims 1-32 are treated on the merits as set forth herein below.

Drawings

3. The drawings were received on February 6, 2004. These drawings are acceptable.
4. The drawings are objected to under 37 CFR 1.83(a) because they fail to show "Figure 6E the flow chart 600 of the exemplary technique of Fig. 6A-6D" as described in the specification in Page 8, lines 6-7. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

5. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required:

Claim 23 recites "The method of claim 1, wherein said implanting said dopant is performed after said implanting said at least one species, said method further comprising annealing said substrate after said implanting said species and before said implanting said dopant" in lines 1-4.

Although, the specification provides support for "implanting said dopant is performed after said implanting said at least one species," as shown in Figs. 5A and 5B and Pages 19 and 20

Art Unit: 2823

of the instant application, the specification does not provide support for “annealing said substrate after said implanting said species and before said implanting said dopant.” Therefore, the specification is objected to as failing to provide proper antecedent basis for the claimed subject matter

Claim Objections

6. Claims 7 and 29 are objected to because of the following informalities:

Claim 7 recites the limitation “The method of claim 6, wherein said junction has a **thickness** of no more than about 30 nm” in lines 1-2. However, 30 nm is actually **depth** of the junction rather than **thickness** as described in the specification (see the instant application specification Page 9 lines 14-18).

Therefore, the examiner respectfully suggests changing “thickness” to --depth-- in order to maintain clarity throughout the claim language that is consistent with the specification.

Appropriate correction is required.

Claim 29 recites the limitation “The device of claim 25, wherein said junction has a thickness of no more than about 30 nm, and a slope which is at least about 5 nm per decade of change in concentration of dopant” in lines 1-3. However, 30 nm is actually **depth** of the junction rather than **thickness** as described in the specification (see the instant application specification Page 9 lines 14-18).

Therefore, the examiner respectfully suggests changing “thickness” to --depth-- in order to maintain clarity throughout the claim language that is consistent with the specification.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-6, 9-12, 18-22, 24, 25, and 30 are rejected under 35 U.S.C. 102(b) as being anticipated by Talwar et al. (US/6,380,044).

Re claim 1, Talwar et al. disclose a method of forming a semiconductor device, comprising: implanting a dopant (i.e., p-type dopant or n-type dopant such as boron or arsenic) (see Col. 7, line 64 – Col. 8, lines 20) (see Figs. 11A-1E), and at least one species (i.e., dopant such Ge, Si, Ar, Xe, etc.) (see Fig. 1B and Col. 7, line 47-Col. 8, line 50) on a semiconductor substrate (10), and annealing the substrate (see Fig. 1F and 1G), said at least one species retarding a diffusion of the dopant during the annealing step of the substrate (i.e., the amorphous region created in the substrate 10 by species 48, See Fig 1B, i.e., species such as Ge, Si, In, Ar, Xe, ... dopant and by species 70, see Fig. 1E, i.e., species such as Ge, Si, In, Ar, Xe, ... prohibits diffusion of the source drain dopant, i.e., B or As, into the channel region as shown in Figs 1F and 1G,) (see Figs. 1A-1G, 2 and 3A-3C).

Re claim 2, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein a dosage of the at least one species exceeds a preamorphization threshold of the substrate (i.e., the disclosed range 1×10^{13} to 1×10^{16} atoms/cm² encompasses the claimed limitations that is dose of species such as Ge, Si, In Ar, Xe, ... exceeds 1×10^{14} ions/cm²

Art Unit: 2823

for Xe and 1×10^{15} ions/cm² for Si, as example provided in the specification of instant application Page 14, lines 1-6) (see Col. 7, lines 53-67).

Re claim 3, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein a dosage of the at least one species is at least about 3 times the preamorphization threshold of the substrate (i.e., dosage 3×10^{14} ions/cm² for Xe and 3×10^{15} ions/cm² for Si) (see Col. 7, lines 53-67).

Re claim 4, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein a dosage of the at least one species is at least about 5 times the preamorphization threshold of the substrate (i.e., 5×10^{14} ions/cm² for Xe and 5×10^{15} ions/cm² for Si) (see Col. 7, lines 53-67).

Re claim 5, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein a dosage of the at least one species is at least about 7 times the preamorphization threshold of the substrate (i.e., 7×10^{14} ions/cm² for Xe and 7×10^{15} ions/cm² for Si) (see Col. 7, lines 53-67).

Re claim 6, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the at least one species damages a junction formed by the dopant (i.e., the 2nd dipper amorphization implant 70 as shown in Fig. 1E damages the junction formed by dopant 50 as shown in Fig. 1C and 1D) (see Figs. 1A-1G, 2 and 3A-3C).

Re claim 9, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the substrate (10) comprises at least one of silicon, SiGe, strained Si and strained SiGe (see Figs. 1A-1G; Col. 6, lines 25-65) .

Art Unit: 2823

Re claim 10, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the at least one species comprises at least one of Xe, Ge, Si, Ar, K.r, Ne, He and N (see Figs. 1A-1G; Col. 7, lines 47-63).

Re claim 11, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the dopant comprises at least one of As, P, and Sb (see Figs. 1A-1G; Col. 7, line 66 – Col. 8, line 8).

Re claim 12, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the dopant is implanted at a time which is one of prior to said implanting said species, and after the implanting said species (i.e., the dopant **50** as depicted in Fig. 1C is implanted prior to the implant species **70** as depicted in Fig. 1E and the dopant **74** is implanted after the species **70** is implanted as depicted in Fig. 1E) (see Figs. 1A-1G; Col. 7, line 64 – Col. 8, line 50).

Re claim 18 as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein said species is implanted at least about 10 to about 20 nm deeper than said dopant (i.e., the dopant **50** has a depth around 30 nm, see Col. 7, lines 53-56, or less in the regions **40** and **44** that created by the first species **48** as depicted in Figs. 1B and 1C, and the second species **70** create a deep doped regions as depicted in Fig. 1E has depth of 50 nm, see Col. 8, lines 34-46, and therefore, the depth of junction created by species **70** is deeper than the dopant **50** junction depth by at least about 10 to about 20 nm) (see Figs. 1A-1G; Col. 7, line 64 – Col. 8, line 50).

Re claim 19, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the species has an implantation energy (i.e., 2 KeV – 100 KeV,

Art Unit: 2823

see Col. 7, lines 47-64) sufficient to create a region surrounding at least a portion of an extension region in the substrate (see Figs. 1A-1G).

Re claim 20, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the species has a first implantation energy sufficient to create a region surrounding at least a portion of an extension region in the substrate (see Fig. 1B), and a second implantation energy sufficient to create a region surrounding at least a portion of a source/drain region in the substrate (see Fig. 1E) (see Figs. 1A-1G; Col. 7, line 24 0 Col. 8, line 50).

Re claim 21, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the species has an implantation energy sufficient to create a region surrounding at least a portion of an extension region and at least a portion of a source/drain region in said substrate (see Figs. 1A-1G; Col. 7, line 24 0 Col. 8, line 50).

Re claim 22, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein the annealing the substrate is performed after the implanting the dopant and the implanting said species (i.e., annealing process is performed after the species implant 48 and 70 and dopant implant 50 and 74 is performed as depicted in Fig. 1F and 1G) (see Figs. 1A-1G; Col. 7, line 24 0 Col. 8, line 50).

Re claim 24, Talwar et al. disclose a method of forming a shallow and abrupt junction in semiconductor substrate, comprising: implanting a dopant (50) on a substrate (10) implanting at least one species (70) in a vicinity of the dopant in a dosage which far exceeds a preamorphization threshold of the substrate (i.e., the disclosed range 1×10^{13} to 1×10^{16} atoms/cm² encompasses the claimed limitations that is dose of species such as Ge, Si, In Ar, Xe, ... exceeds

Art Unit: 2823

1×10^{14} ions/cm² for Xe and 1×10^{15} ions/cm² for Si, as example provided in the specification of instant application Page 14, lines 1-6); and annealing the substrate (10), the at least one species retarding a diffusion of the dopant during the annealing of the substrate (i.e., the implant region created in the substrate 10 by species 48 See Fig 1B , i.e., species such as dopant Ge, Si, In, Ar, Xe, ... , the implant region created in the substrate 10 and species 70, see Fig. 1E, i.e., species such as Ge, Si, In, Ar, Xe, ... prohibits diffusion of the source drain dopant, i.e., B or As, into the channel region as shown in Figs 1F and 1G), such that a shallow junction (60 62) and abrupt junction (80 84) is formed (see Figs. 1A-1G; Col. 6, line 25 – Col. 10, line 63).

Re claim 25, Talwar et al. disclose a semiconductor device, comprising: a semiconductor substrate (10); a dopant formed (60 62) in said substrate (10) to define a junction; and a species formed (48 70) in a vicinity of the junction and in a concentration which far exceeds a preamorphization threshold of the substrate (10) (i.e., the disclosed range 1×10^{13} to 1×10^{16} atoms/cm² encompasses the claimed limitations that is dose of species such as Ge, Si, In Ar, Xe, ... exceeds 1×10^{14} ions/cm² for Xe and 1×10^{15} ions/cm² for Si, as example provided in the specification of instant application Page 14, lines 1-6) (see Figs. 1A-1G; Col. 6, line 25 – Col. 10, line 63).

Re claim 30, as applied to claim 1 above, Talwar et al. teach all the claimed limitation including the limitation wherein said substrate (10) comprises one of silicon, SiGe and strained Si (see Figs. 1A-1G; Col. 6, line 25 – Col. 10, line 63).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 2823

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 7, 8, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Talwar et al. (US/6,380,044).

Re claims 7 and 8, as applied to claim 6 in Paragraph 8 above, Talwar et al. disclose all the claimed limitation including wherein junction having a depth of more than about 30 nm (i.e. 50 nm) and wherein the junction having a slope more than 5 nm per decade of charge in concentration of the dopant. In addition, Talwar et al. also disclose the amorphization depth can be optimized by selecting type dopant species, dopant energy, concentration (see Col. 7, lines 24-63) Furthermore, Talwar et al. also disclose achieving a very shallow junction having sharply defined boundary that have low sheet resistance (see Fig. 2 and Col. 10, line 56 – Col. 11, line 8).

Although Talwar et al. do not specifically disclose the claimed junction depth (i.e., no more than 30 nm) and the claimed slope (i.e., about 5 nm per decade change of concentration), such range would have been achieved within the scope of Talwar et al. disclosure by routine

Art Unit: 2823

optimization of dopant concentration, dopant energy and type of dopant species, thereby forming a very shallow junction and a junction having the slope about 5 nm per decade change of concentration since the slope is directly proportional to the depth of the junction (i.e., slope = dX_j/dC , wherein dX_j is change in depth of the junction and dC is change in the concentration the dopant).

One of ordinary skill in the art would have been motivated to optimize the junction depth by selecting type dopant species, dopant energy, and concentration ranges by using routine experimentation in order to form a junction having depth of 30 nm or lower in the substrate so that lower slope, such as, 5 nm per decade or lower can be measured due to formation of a very shallow junction having sharply defined boundary and as result the substrate would have a very low sheet resistance.

Therefore, it would have been to one having ordinary skill in the art at the time of the invention is made to form a junction having depth of 30 nm or lower in the substrate so that lower slope such as 5 nm per decade or lower can be achieved due formation of very shallow junction, since it has been held where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990); and *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997). Furthermore, the specification contains no disclosure of either the critical nature of the claimed junction depth, i.e., no more than 30 nm and the slope 5 nm per decade of

Art Unit: 2823

change in concentration or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

Re claim 29, as applied to claim 25 in Paragraph 8 above, Talwar et al. disclose all the claimed limitation including wherein junction having a depth of more than about 30 nm (i.e. 50 nm) and wherein the junction having a slope more than 5 nm per decade of charge in concentration of the dopant. In addition, Talwar et al. also disclose achieving a very shallow junction having sharply defined boundary that have low sheet resistance (see Fig. 2 and Col. 10, line 56 – Col. 11, line 8).

Although Talwar et al. do not specifically disclose the claimed junction depth (i.e., no more than 30 nm) and the claimed slope (i.e., about 5 nm per decade change of concentration), such range would have been achieved within the scope of Talwar et al. disclosure by routine optimization of dopant concentration, dopant energy and type of dopant species, thereby forming a very shallow junction and a junction having the slope about 5 nm per decade change of concentration since the slope is directly proportional to the depth of the junction (i.e., slope = dX_j/dC , wherein dX_j is change in depth of the junction and dC is change in the concentration the dopant).

One of ordinary skill in the art would have been motivated to optimize the junction depth by selecting type dopant species, dopant energy, and concentration ranges by using routine experimentation in order to form a junction having depth of 30 nm or lower in the substrate so that lower slope, such as, 5 nm per decade or lower can be measured due to formation of a very

Art Unit: 2823

shallow junction having sharply defined boundary and as result the substrate would have a very low sheet resistance.

Therefore, it would have been to one having ordinary skill in the art at the time of the invention is made to from a junction having depth of 30 nm or lower in the substrate so that lower slope such as 5 nm per decade or lower can be achieved due formation of very shallow junction, since it has been held where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); *Merck & Co. Inc. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); *In re Kulling*, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990); and *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997). Furthermore, the specification contains no disclosure of either the critical nature of the claimed junction depth, i.e., no more that 30 nm and the slope 5 nm per decade of change in concentration or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. See *In re Woodruff*, 919, f.2d 1575, 1578, 16 USPQ2d, 1936 (Fed. Cir. 1990).

11. Re claims 13-17 and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Talwar et al. (US/6,380,044), as applied in Paragraph 8, in view of Yu (US/6,235,599).

Art Unit: 2823

Re claim 13, as applied to claim 1 in Paragraph 8 above, Talwar et al. disclose all the claimed limitations including forming a source (80) and drain region (84) in said substrate (10) (see Figs. 1A-1G).

However, Talwar et al. do not disclose forming a metal silicide contact over said source and drain region.

Yu discloses forming a source (108) and drain (112) in the substrate (102) and forming a metal silicide contact (110 114) over the source (108) and drain (112) region (see Fig. 1). As Yu discloses the silicide contact (110 114) is formed over the source (108) and drain (112) region in order to provide low resistant contact over the source drain region.

One of ordinary skill in the art would have been motivated to modify Talwar et al. teaching by forming a silicide contact in the source drain region in order to form a low resistant contact over the source drain region.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Talwar et al. reference with forming a metal silicide contact over the source and drain region as taught by Yu in order to form a low resistant contact over the source drain region.

Re claim 14, as applied to claim 13 above, Talwar et al. and Yu in combination disclose all the claimed limitations including wherein said source and drain region are formed at a time which is prior to implanting of the dopant (i.e., source extension 60 drain extension 62 are formed prior to doping of species 70 as depicted in Figs. 1B-1E) (see Talwar et al. Figs. 1A-1G and Yu Fig. 1).

Art Unit: 2823

Re claim 15, as applied to claim 13 above, Talwar et al. and Yu in combination disclose all the claimed limitations including wherein said source and drain region are formed at a time which is after the implanting of the dopant (i.e., source extension 60 drain extension 62 are formed prior to doping of species 70 as depicted in Figs. 1B-1E or the source region 80 drain region 82 are formed after doping of species 48 as depicted on Fig. 1B and species 70 as depicted Fig. 1E).

Re claim 16, as applied to claim 14 above, Talwar et al. and Yu in combination disclose all the claimed limitations including wherein the dopant is implanted at a time which is one of prior to said implanting said species, and after said implanting said species (i.e., dopant 50 as depicted in Fig. 1C is implanted prior to implanting of species 70 as depicted in Fig. 1E and dopant 74 is implanted after implanting of species 70 as depicted in Fig. 1E) (see Talwar et al. Figs. 1A-1G and Yu Fig. 1).

Re claim 17, as applied to claim 15 above, Talwar et al. and Yu in combination disclose all the claimed limitations including wherein the dopant is implanted at a time which is one of prior to the implanting the species, and after the implanting the species (i.e., dopant 50 as depicted in Fig. 1C is implanted prior to implanting of species 70 as depicted in Fig. 1E and dopant 74 is implanted after implanting of species 70 as depicted in Fig. 1E) (see Talwar et al. Figs. 1A-1G and Yu Fig. 1).

Re claim 26, as applied to claim 25 above in Paragraph 8, Talwar et al. teach all the claimed limitation including the limitation a source region (80) and a drain region (84) formed adjacent the dopant and the species (see Fig. 1E); a channel formed (see Fig. 1G) between said source and drain regions, a gate formed (36) over the channel (see Figs. 1A-1G)

However, Talwar et al. do not disclose a contact formed over the source and drain regions.

Yu discloses forming a source (108) and drain (112) in the substrate (102) and forming a metal silicide contact (110 114) over the source (108) and drain (112) region (see Fig. 1). As Yu discloses the silicide contact (110 114) is formed over the source (108) and drain (112) region in order to provide low resistant contact over the source drain region.

One of ordinary skill in the art would have been motivated to modify Talwar et al. teaching by forming a silicide contact in the source drain region in order to form a low resistant contact over the source drain region.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Talwar et al. reference with forming a metal silicide contact over the source and drain region as taught by Yu in order to form a low resistant contact over the source drain region.

Re claim 27, as applied to claim 26 above, Talwar et al. and Yu in combination teach all the claimed limitation including the limitation wherein a region of the species surrounds at least a portion of the junction (see Talwar et al. Figs. 1A-1G and Yu Fig. 1).

Re claim 28, as applied to claim 26 above, Talwar et al. and Yu in combination teach all the claimed limitation including the limitation wherein a region of said species surrounds at least a portion of said junction, and at least a portion of said source and drain regions (see Talwar et al. Figs. 1A-1G and Yu Fig. 1).

Art Unit: 2823

12. Claims 30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Talwar et al. (US/6,380,044), as applied in Paragraph 8 above, in view of Sugawara et al. (US/2001/0003364).

Re claim 30 and 31, as applied claim 30 in Paragraph 8 above, Talwar et al. (US/6,380,044) disclose all the claimed limitations.

However, Talwar et al. do not specifically disclose the substrate comprises SiGe and wherein said SiGe comprises one of relaxed SiGe and strained SiGe, strained SiGe comprises SiGe under one of a compressive strain and a tensile strain.

Sugawara et al. disclose the strained/relaxed SiGe substrate comprises one of compressive and tensile strain (see Page 3 Paragraph 0013). Sugawara et al. disclose due to compressive stress generated in SiGe compound provides an increase of mobility of ions that resulted high speed in the device performance.

One of ordinary skill in the art would have been motivated to provide a substrate comprises strained/relaxed SiGe which comprises one of compressive or tensile strain in order to increase mobility of ions so that the speed and the device performance can be increased.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Talwar et al. reference with a substrate comprises strained/relaxed SiGe which comprises one of compressive or tensile strain as taught by Sugawara et al. in order to increase mobility of ions so that the speed and the device performance can be increased.

Art Unit: 2823

Allowable Subject Matter

13. Claim 23 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

14. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record neither anticipates nor renders obvious the claimed subject matter of the instant application as a whole either taken alone or in combination, in particular, prior art of record does not teach “annealing said substrate after said implanting said species and before said implanting said dopant,” as recited in claim 23.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure Saito (US/5,561,072) discloses method of fabricating MOSFET device having a shallow junction, Mineji et al. (US/6,372,591) disclose method fabricating MOSFET device including shallow sources/drain extension having less than 0.1 mm depth, and Xiang (US/6,734,527) discloses method of fabricating CMOS device that having high mobility current based on substrate having strained SiGe.

Remarks

16. Paper copies of the recited U.S. Patents and Patent Application Publications that listed in PTO-892 are not mailed to applicant(s) due to implementation of Electronic Maintenance of Official Patent Application(s) Records. However, the references can be downloaded through the PAIR system.

Correspondence

Art Unit: 2823

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brook Kebede whose telephone number is (571) 272-1862. The examiner can normally be reached on 8-5 Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (571) 272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Brook Kebede
Examiner
Art Unit 2823

Brook Kebede

BK
June 6, 2004